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## (54) FLAME-RETARDANT ANTISTATIC RESIN COMPOSITION AND MOLDED ARTICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an arom. polycarbonate resin compsn. which has persistent good antistatic properties, exhibits a good flame retardance though it does not contain a halogen flame retardant, and is excellent in heat resistance, impact strength, and external appearance.

SOLUTION: This compsn. comprises (A) 50-80% arom. polycarbonate resin, (B) 4.5-15% polyetheresteramide, (C) 3-12% phosphoric ester, (D) 1-25 wt.% at least one inorg. filler selected from among talc having an average particle size of 0.5-10  $\mu\text{m}$ , mica, glass flakes, and wollastonite having an average particle size of 0.5-10  $\mu\text{m}$ , (E) 0.5-8% rubbery polymer, and (F) 0.05-1.5 % polytetrafluoroethylene capable of forming fibrils.

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## CLAIMS

[Claim(s)]

[Claim 1] the resin constituent which consists of the following A-F components -- it is -- (\*\*) -- aromatic series polycarbonate resin (A component)

(b) Polyether ester amide (B component)

(c) Phosphoric ester (C component)

(d) The talc whose mean particle diameter is 0.5-10 micrometers, a mica, a glass flake, and one or more sorts of inorganic bulking agents chosen from straw SUTONAITO whose average diameter is 0.5-10 micrometers (D component)

(e) Gum polymer (E component)

(\*\*) Polytetrafluoroethylene which has fibril organization potency (F component)

The antistatic nature resin constituent which has the fire retardancy characterized by this a-f satisfying following the (1) - (8) type in 100 % of the weight of resin constituents which consist of the above-mentioned A-F component when the rate of each component is made into A component: a % of the weight, B component: b % of the weight, C component: c % of the weight, D component: d % of the weight, E component: e % of the weight, and F component: f % of the weight.

(1) formula  $50 \leq a \leq 80$  (2) type  $4.5 \leq b \leq 15$  (3) type  $3 \leq c \leq 12$  (4) type  $1 \leq d \leq 25$  (5) type  $0.5 \leq e \leq 8$  (6) type  $0.05 \leq f \leq 1.5$  (7) type  $c2-26c+8(14+b-d) \leq 0$  (8) type  $b \geq (3/37)a$  -- [Claim 2] The antistatic nature resin constituent which has the fire retardancy according to claim 1 which is the compound rubber system graft polymer with which the graft polymerization of a kind or two sorts or more of vinyl monomers was carried out to the compound rubber which has the structure to which the gum polymer of E component became entangled mutually so that a polyorganosiloxane rubber component and the poly alkyl (meta) acrylate rubber component could not be separated.

[Claim 3] The antistatic nature resin constituent which the polyether ester amide of B component is guided from the ethylene oxide addition product (B-2 component) of the bisphenols of the polyamide (B-1 component) of number average molecular weight 500-5,000, and number average molecular weight 1,600-3,000 which have a carboxyl group in both ends, and has the fire retardancy according to claim 1 or 2 whose relative viscosity is 1.1-4.0 (a 0.5 % of the weight m-cresol solution, 25 degrees C).

[Claim 4] The antistatic nature resin constituent which has the fire retardancy of a publication in any 1 term of claims 1-3 whose D components are talc which is the mean particle diameter of 0.5-10 micrometers.

[Claim 5] Mold goods formed from the antistatic nature resin constituent which has the fire retardancy of a publication in any 1 term of claims 1-4.

[Translation done.]

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention has the good fire retardancy with which it is satisfied of V-0 in UL 94V trial, without having still more detailed good durability antistatic nature, and including a halogen system flame retarder about an aromatic series polycarbonate resin constituent, and relates to the mold goods which consist of the aromatic series polycarbonate resin constituent and it which were further excellent also in an appearance, thermal resistance, and shock resistance.

[0002]

[Description of the Prior Art] Aromatic series polycarbonate resin is excellent in a mechanical strength, an electrical property, etc., and is broadly used in the electrical-and-electric-equipment field, the automobile field, etc. However, since polycarbonate resin has high electric insulation, it may cause serious damage on [, such as it not only spoiling an appearance, but dust and dust adhering to a mold-goods front face, and damaging in electrical machinery components or carrying out an operation mistake, ] a function. Therefore, continuous maintenance of the grant and the engine performance of antistatic nature is demanded. Furthermore, in the above-mentioned field, in order to fill the demand of safety, the resin constituent which raised fire retardancy is called for strongly, and the resin constituent which attains V-0 in UL 94V trial is called for especially in recent years.

[0003] Although the approach of electric-conduction-izing resin itself as an approach of raising antistatic nature and the approach of adding a surfactant etc. to resin were performed from the former, in the case of the former, it was inferior to shock resistance and workability, and, in the case of the latter, there was a fault of being inferior to durability -- effectiveness falling remarkably by rinsing once.

[0004] As an approach of making continuous antistatic nature giving the alloy of polycarbonate resin or polycarbonate resin, ABS plastics, etc., the resin constituent which contained the polyether ester amide in JP, 7-45612, B, and the resin constituent which contained the special polyether ester amide in JP, 7-233364, A are indicated. However, it was difficult to acquire high fire retardancy, containing an antistatic agent, since an antistatic agent tends [ very ] to burn. Furthermore, the appearance of mold goods becomes a pearl tone and a higher appearance is searched for.

[0005] It is widely used from the approach of using a halogen system flame retarder from the former as an approach of on the other hand giving fire retardancy to a resin constituent being stabilized, and high fire retardancy being given. However, there is a demand of the resin constituent which there is a motion which restricts the use from viewpoints, such as effect of the environment on [ at the time of the ultimate disposal of the product containing this flame retarder ], to technical establishment of ultimate disposal, therefore does not contain a halogen system flame retarder about a halogen system flame retarder in recent years. Since it is the same, when a product contains this flame retarder, the actual condition is that the demand of the constituent which there is a possibility that recycle use may become impossible when the limit of use has become strong in the future, and does not contain a halogen system flame retarder from a viewpoint of this recycle nature, either has become strong.

[0006] About the resin constituent which has durability antistatic nature and is excellent in fire retardancy, a polyamide polyether block copolymer, phosphoric ester and/or the halogenation polymer and the phosphite system compound and/or the phenol system compound, and the resin constituent that mixed polytetrafluoroethylene further are indicated by polycarbonate resin at JP, 7-126513, A. However, after using only phosphoric ester for this official report by invention of a publication and satisfying sufficient antistatic nature, thermal resistance, an appearance, and shock resistance, V-0 was not able to be attained in the UL 94V trial.

[0007] On the other hand in the aromatic series polycarbonate resin constituent, the constituent which attains V-0

without a halogen system flame retarder is indicated from the former. The constituent which consists of aromatic series polycarbonate resin, a thermoplastic graft copolymer, phosphoric ester, polytetrafluoroethylene, a scale-like inorganic bulking agent, and specific compound rubber being indicated, and excelling in a fluidity, thermal resistance, shock resistance, etc., and attaining V-0 in UL 94V trial is shown in JP,7-126510,A. However, this resin constituent does not have antistatic nature.

[0008] Then, in addition to antistatic nature, it has the good fire retardancy with which it is satisfied of V-0 in UL 94V trial, without including a halogen system flame retarder, and the aromatic series polycarbonate resin constituent which was further excellent also in an appearance, thermal resistance, and shock resistance is demanded.

[0009]

[Problem(s) to be Solved by the Invention] Maintaining antistatic nature, it has the good fire retardancy with which it is satisfied of V-0 in UL 94V trial, without including a halogen system flame retarder, and the technical problem of this invention aims at offering the aromatic series polycarbonate resin constituent which was further excellent also in an appearance, thermal resistance, and shock resistance.

[0010] As a result of repeating examination wholeheartedly that the above-mentioned purpose should be attained, when this invention persons blended with aromatic series polycarbonate resin combining a polyether ester amide, phosphoric ester, the specific inorganic bulking agent, the rubber component, and the specific drip inhibitor at a fixed presentation rate, they reached [ that good antistatic nature, the good fire retardancy with which it is satisfied of V-0 in UL 94V trial, and the appearance, heat-resistant, and shock-proof outstanding aromatic series polycarbonate resin constituent are obtained, and ] header this invention further.

[0011]

[Means for Solving the Problem] namely, the resin constituent with which this invention consists of the following A-F components -- it is -- (\*\*) -- aromatic series polycarbonate resin (A component)

(b) Polyether ester amide (B component)

(c) Phosphoric ester (C component)

(d) The talc whose mean particle diameter is 0.5-10 micrometers, a mica, a glass flake, and one or more sorts of inorganic bulking agents chosen from straw SUTONAITO whose average diameter is 0.5-10 micrometers (D component)

(e) Gum polymer (E component)

(\*\*) Polytetrafluoroethylene which has fibril organization potency (F component)

[0012] In 100 % of the weight of resin constituents which consist of the above-mentioned A-F component, when the rate of each component is made into A component:a % of the weight, B component:b % of the weight, C component:c % of the weight, D component:d % of the weight, E component:e % of the weight, and F component:f % of the weight, it is the antistatic nature resin constituent which has the fire retardancy characterized by this a-f satisfying following the (1) - (8) type.

(1) Formula  $50 \leq a \leq 80$  (2) type  $4.5 \leq b \leq 15$  (3) type  $3 \leq c \leq 12$  (4) type  $1 \leq d \leq 25$  (5) type  $0.5 \leq e \leq 8$  (6) type  $0.05 \leq f \leq 1.5$  (7) type  $c2-26c+8 (14+b-d) \leq 0$  (8) type  $b \geq (3/37) a$  [0013] The aromatic series polycarbonate resin

used as an A component of this invention is aromatic series polycarbonate resin which a dihydric phenol and a carbonate precursor are made to react and is obtained. As a dihydric phenol used here, 2 and 2-screw (4-hydroxyphenyl) propane (henceforth bisphenol A), screw (4-hydroxyphenyl) methane, 1, and 1-screw (4-hydroxyphenyl) ethane, 2, and 2-screw (4-hydroxy - 3, 5-dimethylphenyl) propane, 2, and 2-(4-hydroxy-3-methylphenyl) propane, a screw (4-hydroxyphenyl) sulfone, etc. are mentioned. A desirable dihydric phenol is a screw (4-hydroxyphenyl) alkane system, and especially its bisphenol A is desirable. As a carbonate precursor, carbonyl halide, carbonyl ester, halo formate, etc. are mentioned, and the dihaloformate of a phosgene, diphenyl carbonate, and a dihydric phenol etc. is specifically mentioned. In manufacturing polycarbonate resin, the above-mentioned dihydric phenol may be used independently, or two or more sorts may be used together, and

polycarbonate resin may be branching polycarbonate resin which copolymerized the polyfunctional aromatic compound of three or more organic functions, or may be the mixture of two or more sorts of polycarbonate resin.

[0014] since melt viscosity will become high and it will be hard coming to fabricate it, if too high [ if too low, reinforcement is not enough, and ] although it is not necessary to restrict especially the molecular weight of polycarbonate resin -- viscosity average molecular weight -- expressing -- usually -- 10,000-50,000 -- it is 15,000-40,000 preferably. Viscosity average molecular weight (M) here inserts and asks a degree type for the specific viscosity ( $\eta_{sp}$ ) for which it asked from the solution which dissolved 0.7g of polycarbonate resin in 100ml of methylene chlorides at 20 degrees C.

$\eta_{sp}/C = [\eta] + 0.45 \times [\eta]^2 C$   $[\eta] = 1.23 \times 10^{-4} M^{0.83}$  (however  $[\eta]$  being limiting viscosity and  $C$  being polymer concentration 0.7)

[0015] Next, a fundamental means to manufacture polycarbonate resin is explained briefly. In the solution method using a phosgene as a carbonate precursor, it usually reacts to the bottom of existence of an acid binder and an organic solvent. As an acid binder, amine compounds, such as a hydroxide of alkali metal, such as a sodium hydroxide and a potassium hydroxide, and a pyridine, are mentioned. Halogenated hydrocarbon, such as a methylene chloride and a chlorobenzene, is used as an organic solvent. Moreover, it is desirable to be able to use the catalyst of a tertiary amine, quaternary ammonium salt, etc. for promotion of a reaction, and to use end halt agents, such as a phenol and an alkylation phenol like p-tert-butylphenol, as a molecular-weight modifier. It is desirable for reaction temperature to keep pH under reaction at 0-40 degrees C, and to usually keep reaction time or more at ten for several minutes to 5 hours. In addition, not all the chain ends obtained as a result need to have the structure of the origin in an end halt agent.

[0016] In the ester exchange reaction (scorification) using carbonic acid diester as a carbonate precursor, it stirs heating the dihydric phenol of a predetermined rate with carbonic acid diester under existence of inert gas, and carries out by the approach of making the alcohol or phenols to generate distilling. Although reaction temperature changes with boiling points of the alcohol to generate or phenols etc., it is usually the range of 120-300 degrees C. A reaction completes a reaction, making the alcohol or phenols which makes reduced pressure and is generated from the first stage distill. An end halt agent is made to add simultaneously with a dihydric phenol etc. by the initial stage of this reaction by stages in the middle of a reaction. Moreover, in order to promote a reaction, the catalyst used for a well-known ester exchange reaction now can be used. As carbonic acid diester used for this ester exchange reaction, diphenyl carbonate, dinaphthyl carbonate, dimethyl carbonate, diethyl carbonate, dibutyl carbonate, etc. are raised, for example. Diphenyl carbonate is [ especially among these ] desirable.

[0017] The polyether ester amide used as a B component in this invention is guided from the ethylene oxide addition product (B-2 component) of the polyamide (B-1 component) of the number average molecular weight 500-5,000 which has a carboxyl group in both ends, the polyethylene glycol of number average molecular weight 300-4,000, and/or the bisphenols of number average molecular weight 300-4,000, and the relative viscosity in 25 degrees C in a 0.5 % of the weight m-cresol solution satisfies 1.1-4.0. By using this polyether ester amide, the resin constituent of this invention will have good antistatic nature, fire retardancy, and thermal resistance.

[0018] The polyamide of the number average molecular weight 500-5,000 which has a carboxyl group is (1) lactam ring-opening-polymerization object, the polycondensation object of (2) amino carboxylic acid, or (3) dicarboxylic acid and the polycondensation object of diamine, and a caprolactam, an ENANTO lactam, capryl, a RAURO lactam, etc. are mentioned to the both ends used as this B-1 component as a lactam of (1). As an amino carboxylic acid of (2), omega-aminocaproic acid, omega-amino enanthic acid, omega-amino caprylic-acid, omega-amino pel gon acid, omega-amino capric-acid, 1, and 1-amino undecanoic acid and 1, and 2-amino dodecanoic acid etc. is mentioned. As dicarboxylic acid of (3), an adipic acid, an azelaic acid, a sebacic acid, a UNDEKANJI acid, a DODEKANJI acid, isophthalic acid, etc. are mentioned, and a hexamethylenediamine, heptamethylene diamine, octamethylene diamine, deca methylene diamine, etc. are mentioned as diamine of (3). Use of a caprolactam, 12-amino-dodecanoic-acid, and adipic-acid-hexamethylenediamine is desirable, and use of a caprolactam is [ among these ] more desirable especially.

[0019] The dicarboxylic acid component of the carbon atomic numbers 4-20 is used for B-1 component as a molecular weight modifier, and the above-mentioned amide plasticity monomer is obtained ring opening polymerization or by carrying out a polycondensation with a conventional method under this existence. As dicarboxylic acid of the carbon atomic numbers 4-20, aliphatic series dicarboxylic acid, such as aliphatic series dicarboxylic acid, such as a terephthalic acid, isophthalic acid, and a phthalic acid, or a succinic acid, oxalic acid, an adipic acid, a sebacic acid, and a DODEKANJI acid, is mentioned, especially, use of a terephthalic acid, isophthalic acid, an adipic acid, a sebacic acid, and a DODEKANJI acid is desirable from the point of polymerization nature and physical properties, and especially a terephthalic acid has it from a heat-resistant point. [ desirable ]

[0020] the number average molecular weight of B-1 component -- 500-5,000 -- it is 500-3,000 preferably. If the thermal resistance of the polyether ester amide itself falls less than by 500 and number average molecular weight exceeds 5,000, reactivity will fall and great time amount will be required at the time of manufacture of a polyether ester amide.

[0021] As bisphenols of the ethylene oxide addition product of the bisphenols used in B-2 component, bisphenol A, screw (4-hydroxyphenyl) methane, screw (4-hydroxyphenyl) sulfone and 2, and 2-screw (4-hydroxyphenyl)

butane etc. is mentioned, and use of bisphenol A is desirable especially. B-2 component is obtained by adding ethylene oxide with a conventional method to these bisphenols. Moreover, other alkylene oxide (propylene oxide, 1, 2-butylene oxide, 1, 4-butylene oxide, etc.) can also be used together with ethylene oxide.

[0022] The number average molecular weight of the ethylene oxide addition product of the polyethylene glycol of the B-2 above-mentioned component, and bisphenols is 300-4,000, and is 1,600-3,000 more preferably. Since reactivity will fall if the number average molecular weight of B-2 component becomes insufficient [ less than 300 / the antistatic effectiveness ] and exceeds 4,000, it has great time amount at the time of polyether ester amide manufacture. In this B-2 component, the number of ethylene oxide addition mols is the thing of 32-60 especially preferably from a heat-resistant viewpoint using the ethylene oxide addition product of bisphenols.

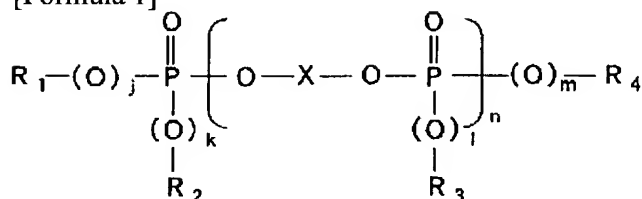
[0023] As for B-2 component, it is desirable to be used in 20 - 80% of the weight of the range of the total quantity of said B-1 component and B-2 component. Since the thermal resistance of a polyether ester amide will fall if the amount of B-2 component is inferior in the antistatic nature of a polyether ester amide and exceeds 80 % of the weight at less than 20 % of the weight, it is not desirable. Moreover, B components may be two or more sorts of mixture.

[0024] Make an amide plasticity monomer and dicarboxylic acid react, B-1 component is made to form about the manufacture approach of the polyether ester amide used for this invention, B-2 component is added to this, and although B component of this invention can be manufactured by the approach of performing a polymerization reaction under an elevated temperature and reduced pressure etc., especially a polymerization method is not limited. The relative viscosity of the polyether ester amide of this B component is 1.1-4.0 (a 0.5 % of the weight m-cresol solution, 25 degrees C), and is 1.3-3.0 preferably. Relative viscosity is inferior to thermal resistance by less than 1.1, and if 4.0 is exceeded, a moldability will fall.

[0025] It is one sort expressed with the following type as phosphoric ester used as a C component by this invention, or two sorts or more of phosphoric ester.

[0026]

[Formula 1]



[0027] however, X in the above-mentioned formula -- hydroquinone, resorcinol, and screw (4-hydroxy diphenyl) methane -- Bisphenol A, dihydroxydiphenyl, dihydroxy naphthalene, A screw (4-hydroxyphenyl) sulfone, a screw (4-hydroxyphenyl) ketone, What is guided from screw (4-hydroxyphenyl) sulfide is mentioned. j, k, l, and m are 0 or 1 independently, respectively, and n is the integer of 0-5. or in the blend of phosphoric ester which is different more than in n, it is the average of 0-5, and R1, R2, R3, and R4 are guided independently from a phenol, cresol, a xylenol, an isopropyl phenol, butylphenol, and p-cumyl phenol, respectively.

[0028] Furthermore, preferably, that to which X in the above-mentioned formula is guided from hydroquinone, resorcinol, and bisphenol A is mentioned, j, k, l, and m are 1, respectively, and n is the integer of 0-3, or, in the blend of phosphoric ester which is different more than in n, it is the average of 0-3, and R1, R2, R3, and R4 are guided independently from a phenol, cresol, and a xylenol, respectively.

[0029] Moreover, preferably, X is guided from resorcinol, j, k, l, and m are 1, respectively, n is 0 or 1, and R1, R2, R3, and R4 are especially guided independently from a phenol or a xylenol, respectively.

[0030] It can be especially used preferably for the reasons of the fire retardancy of a resorcinol screw (dixylenyl phosphate) being good as triphenyl phosphate and condensed-phosphoric-acid ester as a mono-phosphate compound, and there being little metal mold contamination at the time of shaping etc. also in this phosphoric ester.

[0031] One or more sorts chosen from straw SUTONAITO the talc whose mean particle diameter is 0.5-10 micrometers, a mica, a glass flake, and whose average diameter are 0.5-10 micrometers as an inorganic bulking agent used as a D component in this invention are mentioned. The mean particle diameter or the average diameter said here is measured by the laser diffraction method in talc, a mica, and a glass flake, and the average of 100 diameters of fiber which took the 1,000 times as many photograph as this, and extracted it indiscriminately among the photograph computes straw SUTONAITO with a scanning electron microscope in straw SUTONAITO. This

mean particle diameter or average diameter is 1-7 micrometers more preferably. When this mean particle diameter or average diameter is smaller than 0.5 micrometers, the reinforcement effectiveness becomes inadequate, and when larger than 10 micrometers, in rigidity and thermal resistance, a desirable appearance is not acquired preferably.

[0032] Three or less % of the weight of a thing is mentioned, and especially a limit does not have the content of Fe<sub>2</sub>O<sub>3</sub> which is an impurity in respect of a hue etc. more preferably as talc of a specific particle size which is D component of this invention about the process of this talc, and axial flow mold mill relation, ANYURA mold mill relation, the roll mill method, the ball mill method, the jet mill method, container rotating type compression shearing-die mill relation, etc. can be used. Furthermore, this talc is desirable at the point of not making a binder resinous principle what is a state of aggregation in respect of the handling nature etc. being desirable, and simple [ the approach as this process, there are an approach by degassing compression, the approach of compressing using binder resin, etc., and according especially to degassing compression ], and unnecessary mixing into the constituent of this invention.

[0033] As a mica of a specific particle size which is D component of this invention, although any mica can use a muscovite, phlogopite, a biotite, an artificial mica, etc., since it is flexible compared with a muscovite, phlogopite and especially a biotite have use of a muscovite desirable from the field of rigid reservation. Moreover, as a grinding method for manufacture of this mica, although a dry grinding method and a wet-grinding method are mentioned, thinner grinding is possible and the thing of a wet-grinding method which is easy to secure rigidity is more desirable. furthermore, any of the approach of compressing as this process using the approach what is a state of aggregation from the point of the handling being desirable as for this mica, and according to degassing compression, and binder resin -- although -- it can be used.

[0034] The approach of anything of a glass kind using E glass, C glass, etc., and crushing general melting parison as the manufacture approach as a glass flake of a specific particle size which is D component of this invention, or a sol-gel method can be used, and since a sol-gel method obtains a thin glass flake especially, it can be used preferably.

[0035] As straw SUTONAITO of the specific diameter which is D component of this invention, it is substantially expressed with a chemical formula CaSiO<sub>3</sub>, and usually SiO<sub>2</sub> contains about 50% of the weight, CaO contains about 47 % of the weight, other Fe(s) 2O<sub>3</sub>, and aluminum 2O<sub>3</sub> grade, what ground and classified straw SUTONAITO rough is said, and, generally it is used as resin reinforcement.

[0036] The talc which is D component of this this invention, a mica, a glass flake, and straw SUTONAITO can use that by which surface preparation is carried out by various well-known silane system coupling agents, the titanate system coupling agent, and the aluminate coupling agent, and can aim at control of disassembly of aromatic series polycarbonate resin, and improvement in the adhesion of resin and an inorganic bulking agent by this surface preparation now. The silane system coupling agent containing especially an epoxy group can use it more preferably. In addition, since this coupling agent demonstrates effectiveness also with the sufficient approach of adding in case the resin constituent of this invention is manufactured, it can be used.

[0037] Of course, the use by one sort of the talc which is D component of this this invention, a mica, a glass flake, and straw SUTONAITO is possible also for using two or more sorts together according to the purpose. When especially a hue is taken into consideration, use of a glass flake is desirable, and when considering rigidity etc., use of a mica and straw SUTONAITO is desirable. When using especially talc, since it excels in the balance of a hue, rigidity, etc., it is used especially preferably.

[0038] What copolymerizes two or more sorts of monomers chosen from the group which consists of methacrylic ester, acrylic ester, and an aromatic series vinyl compound, and is obtained under existence of the rubber which contains the repeat unit of the butadiene origin as a gum polymer which is E component used in this invention is mentioned. As rubber containing the repeat unit of this butadiene origin, polybutadiene, Butadiene Styrene, Butadiene Acrylonitrile, a butadiene-acrylic ester copolymer, etc. are mentioned, for example. As methacrylic ester, a methyl methacrylate, ethyl methacrylate, methacrylic-acid butyl, and methacrylic-acid octyl can be mentioned, for example. As acrylic ester, a methyl acrylate, an ethyl acrylate, butyl acrylate, acrylic-acid octyl, etc. are mentioned, for example. Moreover, as an aromatic series vinyl compound, styrene, alpha methyl styrene, p-methyl styrene, alkoxy styrene, halogenation styrene, etc. are mentioned, for example. The above-mentioned elastic copolymer may be manufactured by which polymerization method of a bulk polymerization, solution polymerization, a suspension polymerization, and an emulsion polymerization, and even if the method of copolymerization is an one-step graft and it is a multistage graft, it does not interfere. Moreover, you may be mixture with the copolymer of only the graft component which carries out a byproduction in the case of



manufacture. It is marketed and this elastic copolymer can be received easily. For example, the money ace B series of Kaneka Co., Ltd., the meta-BUREN C series of Mitsubishi Rayon, the EXL series of Kureha Chemical Industry Co., Ltd., HIA series, BTA series, KCA series, etc. are mentioned.

[0039] As a gum polymer which is E component used in this invention, a fire-resistant property better when the compound rubber system graft polymer with which the graft polymerization of a kind or two sorts or more of vinyl system monomers was carried out is also mentioned to the compound rubber which has the structure which became entangled mutually and it uses this graft polymer, and shock resistance are obtained so that a polyorganosiloxane rubber component and the poly alkyl (meta) acrylate rubber component cannot be separated, and it can be used preferably. In order to obtain the compound rubber system graft copolymer used in this this invention, it is obtained by carrying out a polymerization first, since an emulsion polymerization adjusts the latex of polyorganosiloxane rubber using various kinds of annular ORGANO siloxanes, for example, hexa methyl cyclotrisiloxane, octamethylcyclotetrasiloxane, decamethyl cyclopentasiloxane, etc. and cross linking agents and/or graft decussation agents of three or more membered-rings and then an alkyl (meta) acrylate monomer, a cross linking agent, and a graft decussation agent are infiltrated into the latex of polyorganosiloxane rubber. As an alkyl (meta) acrylate monomer used here, although alkyl methacrylate, such as alkyl acrylate, such as methyl acrylate, ethyl acrylate, n-propylacrylate, n-butyl acrylate, and 2-ethylhexyl acrylate, and hexyl methacrylate, and 2-ethylhexyl methacrylate, is mentioned, it is desirable to use especially n-butyl acrylate.

[0040] as a vinyl system monomer which carries out graft polymerization to this compound rubber, acrylic ester, such as methacrylic ester, such as vinylcyanide compounds, such as aromatic series vinyl compounds, such as styrene and alpha methyl styrene, acrylonitrile, and a methacrylonitrile, methyl methacrylate, and 2-ethylhexyl methacrylate, methyl acrylate, ethyl acrylate, and butyl acrylate, etc. is mentioned, and these are independent -- or two or more sorts are combined and it is used. What is especially marketed from Mitsubishi Rayon as a desirable thing also in this compound rubber system graft copolymer by the trade name of meta-BUREN S-2001 or RK-200 is mentioned.

[0041] In this invention, in order to raise the fire-resistant engine performance further, the polytetrafluoroethylene which has fibril organization potency as an F component is added. The polytetrafluoroethylene which has this fibril organization potency is classified into Type 3 in ASTM specification. Since the polytetrafluoroethylene which has fibril organization potency has the melting dropping prevention engine performance in the perpendicular combustion test of UL at the time of combustion of a test piece, it gives still much more fire-resistant high effectiveness, without reducing the durability antistatic engine performance. The polytetrafluoroethylene which has this fibril organization potency is marketed as Pori Flon from Daikin Industries, LTD. as Teflon 6J, and is easily more nearly available than Dupont-Mitsui Fluorochemicals, Inc.

[0042] When the blending ratio of coal of A component in this invention - F component makes the rate of each component A component:a % of the weight, B component:b % of the weight, C component:c % of the weight, D component:d % of the weight, E component:e % of the weight, and F component:f % of the weight among 100 % of the weight of resin constituents which consist of an A component - F component, this a-f satisfies following the (1) - (8) type.

(1) A formula  $50 \leq a \leq 80$  (2) types  $4.5 \leq b \leq 15$  (3) types  $3 \leq c \leq 12$  (4) types  $1 \leq d \leq 25$  (5) types  $0.5 \leq e \leq 8$  (6) types  $0.05 \leq f \leq 1.5$  (7) types :  $c2-26c+8(14+b-d) \leq 0$  (8) types :  $b \geq (3/37)a$  [0043] The blending ratio of coal of A component becomes less enough [ fire retardancy and thermal resistance ] at less than 50 % of the weight, and when exceeding 80 % of the weight, antistatic nature and a fire-resistant good thing are no longer obtained. When the blending ratio of coal of B component is less than 4.5 % of the weight, antistatic nature is not enough, and in exceeding 15 % of the weight, it has a bad influence on fire retardancy. Thermal resistance becomes less enough when sufficient fire retardancy is not acquired when the blending ratio of coal of C component is less than 3 % of the weight, but exceeding 12 % of the weight. When the blending ratio of coal of D component is less than 1 % of the weight, sufficient fire retardancy is not acquired, but in exceeding 25 % of the weight, an appearance gets worse, and a fire-resistant and heat-resistant good thing is no longer obtained. When the blending ratio of coal of E component is less than 0.5 % of the weight, sufficient shock resistance is not obtained, but in exceeding 8 % of the weight, it has a bad influence on fire retardancy. When the blending ratio of coal of F component is less than 0.05 % of the weight, sufficient fire retardancy is not acquired, but in exceeding 1.5 % of the weight, an appearance gets worse. (7) When not satisfying a formula, in fire retardancy, V-0 of UL 94V trial cannot be attained, and when not satisfying (8) types, sufficient antistatic nature cannot be attained.

[0044] That is, when satisfying the above-mentioned formula, while having sufficient durability antistatic function, the constituent which attains V-0 in UL-94 specification is obtained, and it excels also in thermal resistance, shock



resistance, and an appearance further, and becomes the constituent which fully attains the purpose of this invention.

[0045] Although the resin constituent of this invention uses the above-mentioned A component - F component as an indispensable component, it can blend below 5 weight sections with a standard to a total of 100 weight sections of range, i.e., A component, - F component which do not check the purpose of this invention for various additives, other synthetic resin, etc. if needed further. As various additives, an antioxidant, light stabilizer, an ultraviolet ray absorbent, lubricant, a plasticizer, a release agent, an antistatic agent, a coloring agent, etc. are mentioned. As said synthetic resin, polyester, polyethylene, polypropylene, a polyamide, polyphenylene ether, polymethylmethacrylate, etc. can be mentioned.

[0046] It can mix with mixers, such as a tumbler, a V type blender, a NAUTA mixer, a Henschel mixer, a Banbury mixer, a kneading roll, and an extruder, and the resin constituent of this invention can manufacture the various addition components used if needed [ said / each component and if needed ]. And the heating temperature for kneading is usually chosen in 240 degrees C - 300 degrees C. The resin constituent obtained in this way applies extrusion molding, injection molding, compression molding, blow molding, calender shaping, blow molding, a vacuum forming, etc., and is usable for broad applications, such as required electronic electrical and electric equipment, OA components, etc., such as antistatic nature and fire retardancy.

[0047]

[Embodiment of the Invention] An example is given and explained below. In addition, evaluation was performed by the following approach. Moreover, front Naka shows wt% and certain \*\*\*\*\* %.

[0048] (1) Rigidity : ASTM The bending elastic modulus was measured according to D790.

(2) Shock resistance : ASTM According to D256, 1/8" of impact resistance values-proof [ with the Izod notch ] in thickness was measured.

(3) Thermal resistance : ASTM According to D648, load deflection temperature was measured by 18.6 kgf/cm2 load.

(4) Flammability : the combustion test was carried out according to UL 94V. V-0 is considered as success.

(5) Surface specific resistance : JIS According to K6911, the plate (100x100x2mm) obtained by carrying out injection molding was measured with the superinsulation ohm-meter (Toa Electronics Make, SM-10E) after 96-hour neglect to 20 degrees C and the thermostatic chamber of 65%RH. Furthermore, after measurement, after water washed enough and removing surface moisture, it was left in 23 degrees C and the thermostatic chamber of 65%RH for 24 hours, and measured again. A surface specific resistance value is excellent in antistatic nature, so that it is small. The value of  $1 \times 10^{14}$  ohms or less is considered as success.

(6) Appearance : the judgment according the surface appearance of the corner guard fabricated in the 90mmx50mmx2mm dimension to viewing was performed. The good thing of a surface appearance was made into O, and except [ its ] was made into x. There is that the front face on which the flow mark is conspicuous (it writes by x-1) and where a pearl tone is strong (it writes by x-2) is ruined as an example of x (it writes by x-3) etc.

[0049] After mixing each component of a publication with an amount given in front, and a V type blender to examples 1-10 and the [examples 1-11 of comparison] tables 1-3, the twin screw extruder [KTX30 by Kobe Steel, Ltd.] was supplied, and at the temperature of 260 degrees C, it kneading-extruded and pelletized. Furthermore, after drying the obtained pellet at 120 degrees C for 5 hours, 260 degrees C of cylinder temperatures were created with the injection molding machine [T[ by FANUC, LTD. ]-150D], the test piece was created with the die temperature of 60 degrees C, and the evaluated result was shown in Table 1 and 2. In addition, the notation which shows each component of a publication in Tables 1-3 is as follows.

[0050] (A component)

1) bisphenol A mold polycarbonate resin [of viscosity average molecular weight 25,000 -- panlight L-1250; -- Teijin -- Formation -- make --] (it is written as the following A1.) --

2) bisphenol A mold polycarbonate resin [of viscosity average molecular weight 19,500 -- panlight L-1225L; -- Teijin -- Formation -- make --] (it is written as the following A2.) --

(B component)

1) polyether ester amide (polyamide part: polyether ester partial = about 50:50) [PERESUTATTO 6321; Mitsuhiro the polyamide (number average molecular weight 1,000 [ about ]) which has a carboxyl group in the both ends obtained by carrying out ring opening polymerization of the epsilon caprolactam under existence of a terephthalic acid, and whose relative viscosity guided from the bisphenol A ethylene oxide addition product (number average molecular weight 2,000 [ about ]) are 1.7 (a 0.5 % of the weight m-cresol solution, 25 degrees C) -- Formation -- make --] (it is written as the following B1.) --

2) The polyamide (number average molecular weight 1,300 [ about ]) which has a carboxyl group in the both ends obtained by carrying out the polymerization of the 12-amino dodecanoic acid under existence of an adipic acid, and the polyether ester amide whose relative viscosity guided from the polyethylene glycol (number average molecular weight 1,000 [ about ]) is 2.1 (a 0.5 % of the weight m-cresol solution, 25 degrees C) (polyamide part: polyether ester partial = about 50:50) [PEBAKKUSU MX-1074; Atochem make] (it is written as B-2 below.)

3) The polyamide which has a carboxyl group in the both ends obtained by carrying out the polymerization of the hexamethylenediamine under existence of an adipic acid, and the polyether ester amide guided from the polyethylene glycol [PEBAKKUSU 4011; Toray Industries, Inc. make] (it is written as the following B3.) (C component)

1) Triphenyl phosphate [the product made from S-4; Daihachi Chemistry] (it is written as the following C1.)

2) Resorcinol screw (dixylenyl phosphate) [the product made from PX-200; Daihachi Chemistry] (it is written as the following C2.)

(D component)

1) the talc [HST-0.8; wood whose mean particle diameter measured by the laser diffraction method is 5 micrometers -- Formation -- make --] (it is written as the following D1.) --

2) Straw SUTONAITO whose diameter of fiber measured with the scanning electron microscope is 4 micrometers [SAIKA tech NN-4; Tomoe Engineering make] (it is written as the following D2.)

(Inorganic bulking agents other than D component) The glass fiber of 13 micrometers of diameters of fiber [ECS03T-511/P; Nippon Electric Glass Co., Ltd. make] (it is written as the following D3.)

(E component)

Compound rubber to which the polyorganosiloxane component and the poly alkyl methacrylate rubber component have the mutual invasion network structure [meta-BUREN S-2001; Mitsubishi Rayon Co., Ltd. make] (it is written as the following E1.)

MBS resin [-- Palaloid EXL[ by Kureha Chemical Industry Co., Ltd. ]-2602] (it is written as the following E2.)

(F component)

Polytetrafluoroethylene [FA-500; Daikin Industries, LTD. make] (it is written as the following F1.)

[0051]

[Table 1]

項目	[単位]	実施例1	実施例2	実施例3	比較例1	実施例4	比較例2	比較例3
組成	A1 [wt %]	69.7	69.7	55.7	74.7	73.2	78.2	65.7
	B1 [wt %]	7		5		7	7	12.5
	B2 [wt %]		7		5			
	C1 [wt %]	8	8	10	4.5	4.5	4.5	5
	D1 [wt %]	10	10	22	10	10	5	12.5
	E1 [wt %]	5	5	7	5	5	5	4
	F1 [wt %]	0.3	0.3	0.3	0.3	0.3	0.3	0.3
樹脂量合計 [wt %]		100	100	100	100	100	100	100
	(7) 式条件 (注1)	○	○	○	○	○	×	×
	(8) 式条件 (注2)	○	○	○	×	○	○	○
特性値	曲げ弾性率 [kgf/cm <sup>2</sup> ]	28000	28000	41000	30000	28000	24000	26000
	1/8"衝撃値 [kgf・cm/cm]	58	53	20	53	60	66	63
	荷重たわみ温度 [℃]	95	92	86	108	109	109	104
	難燃性	V-0	V-0	V-0	V-0	V-0	V-1	V-1
	表面抵抗値 (水洗前) [ $\times 10^{12}\Omega$ ]	3	3	6	30	4	6	0.01
	表面抵抗値 (水洗後) [ $\times 10^{12}\Omega$ ]	3	3	6	30	4	6	0.01
	外観	○	○	○	○	○	○	○

注1: (7) 式の条件を満足する場合は○、満足しない場合は×とする。

注2: (8) 式の条件を満足する場合は○、満足しない場合は×とする。

[0052]

[Table 2]

項目	比較例4	比較例5	比較例6	比較例7	比較例8	比較例9	実施例5
組成	A1 [wt%]	76.7	77.7	68.2	76.7	74.7	70
	A2 [wt%]						73.2
	B1 [wt%]		7	19		7	7
	B3 [wt%]				10		
	C1 [wt%]	8		7.5	13	8	8
	D1 [wt%]	10	10			10	10
	E1 [wt%]	5	5	5		5	5
	F1 [wt%]	0.3	0.3	0.3	0.3	0.3	0.3
	樹脂量合計 [wt%]	100	100	100	100	100	100
特性	(7) 式条件 (注1)	○	×	×	×	○	○
	(8) 式条件 (注2)	×	○	○	○	○	○
	曲げ弾性率 [kgf/cm <sup>2</sup> ]	34000	26000	22000	21000	30000	28000
	1/8"耐衝撃値 [kgf・cm/cm]	50	68	70	13	8	58
	荷重たわみ温度 [°C]	100	129	87	72	95	95
	難燃性	V-1	not-V	not-V	V-2	V-0	V-2
	表面抵抗値 (水洗前) [ $\times 10^{12}\Omega$ ]	4000	6	0.0001	0.4	4	3
	表面抵抗値 (水洗後) [ $\times 10^{12}\Omega$ ]	4000	6	0.0001	0.4	4	3
	外觀	○	X-1	X-2	X-2	○	○

注1: (7) 式の条件を満足する場合は○、満足しない場合は×とする。

注2: (8) 式の条件を満足する場合は○、満足しない場合は×とする。

[0053]

[Table 3]

項目	実施例6	実施例7	比較例10	実施例8	実施例9	比較例11	実施例10
組成	A1 [wt%]	69.7	69.7	69.7	63.7	54.7	63.7
	B1 [wt%]	7	7	7	7	13	7
	C1 [wt%]		8	8	8	13	4
	C2 [wt%]	8					
	D1 [wt%]	10			10	10	20
	D2 [wt%]		10				
	D3 [wt%]			10			
	E1 [wt%]	5	5	5		5	5
	E2 [wt%]				5		
特性	F1 [wt%]	0.3	0.3	0.3	0.3	0.3	0.3
	樹脂量合計 [wt%]	100	100	100	100	100	100
	(7) 式条件 (注1)	○	○	○	○	○	○
	(8) 式条件 (注2)	○	○	○	○	○	○
	曲げ弾性率 [kgf/cm <sup>2</sup> ]	28000	30000	32000	28000	25000	40000
	1/8"耐衝撃値 [kgf・cm/cm]	56	60	28	36	60	15
	荷重たわみ温度 [°C]	101	95	95	95	91	74
	難燃性	V-0	V-0	V-0	V-0	V-0	V-0
	表面抵抗値 (水洗前) [ $\times 10^{12}\Omega$ ]	3	4	4	3	0.006	0.5
備考	表面抵抗値 (水洗後) [ $\times 10^{12}\Omega$ ]	3	4	4	3	0.006	0.5
	外觀	○	○	X-3	○	○	○

注1: (7) 式の条件を満足する場合は○、満足しない場合は×とする。

注2: (8) 式の条件を満足する場合は○、満足しない場合は×とする。

[0054] In not satisfying (8) types even when B component of the same rate is included if an example 3 is compared with the example 1 of a comparison from this table, it turns out that a surface-electrical-resistance value is not enough. In addition, B1 component and B-2 component understand that there is no difference from the comparison of examples 1 and 2 at the antistatic engine performance. On the other hand, although the example 1 of a comparison and an example 4 are equivalent load deflection temperature, it turns out that a big difference is in the antistatic engine performance. Even if it is the case where C component of the same rate is similarly included from the comparison with an example 4 and the example 2 of a comparison, in not satisfying (7) types, it turns out that

V-0 cannot be attained in fire retardancy. Moreover, when each component is missing (i.e., when B component is missing like the example 4 of a comparison), antistatic nature is not demonstrated, and fire retardancy not only becomes inadequate, but an appearance is not improved when there is no D component like the examples 6 and 7 of a comparison. Even if it increases only the phosphoric ester of C component like especially the example 7 of a comparison, V-0 made into a target cannot be attained, and an appearance and thermal resistance are also sharply inferior. That is, only by phosphoric ester, maintaining antistatic nature, an appearance is good and thermal resistance is also understood that it is difficult to obtain V-0 good constituent. Moreover, when there is no E component so that the example 8 of a comparison may see, shock resistance is not enough, and when there is no F component, even if it has satisfied (7) types, V-0 cannot be attained. Furthermore, when a glass fiber is used instead of D component like the example 9 of a comparison, it turns out that an appearance becomes inadequate.

[0055]

[Effect of the Invention] The resin constituent of this invention can provide with a product with few [ nature / prospective / recycle ] problems OA equipment, home electronics, etc. which have good fire retardancy, without having good durability antistatic nature and including a halogen system flame retarder, are further excellent also in thermal resistance, shock resistance, and an appearance, and need antistatic nature and fire retardancy useful.

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[Translation done.]